The Northwestern MILLER
MILLING PRODUCTION SECTION

# The Challenge Presented to Cereal Chemists by Flour Specifications for White Pan Bread

*By George Garnatz*
**Director, Kroger Food Foundation**

CEREAL chemistry was formalized as a profession more than 35 years ago by the establishment of the American Association of Cereal Chemists. Through the association has been fostered the acquisition of much knowledge through annual meetings, sectional meetings, the journals Cereal Chemistry and Transactions and awards of the Thomas Burr Osborne medal. However, this knowledge needs to be integrated in more coherent form for effective application.

Cereal Laboratory Methods, the Monograph series and the support of Biological Abstracts are instances of a move in that direction but, notwithstanding, the current status of our knowledge is like the pieces of a mossaic needing to be put together in proper relation so that the general scheme becomes apparent, more meaningful and better understood. Certainly, this is the challenge to cereal chemists, especially in the applied fields.

One hears much talk about gaining greater recognition for the services rendered by chemists and an improved economic status for chemists, engineers and scientists in general. I am quite sure that the cereal chemist shares in these views.

**"Must Capitalize on Opportunities"**

Toward this end, the cereal chemist, particularly in industry, has a great measure of responsibility. He must not limit himself solely to the routine function of control. He must capitalize on the opportunities, either made or given, to serve through technical services, trouble-shooting, product development and research. He should make of his job what he can and by supplementing his practice of technology with initiative and "sell," seek to make his function a contributing, essential element in his organization's structure.

Mill and bakery management have some responsibility, too. They should reciprocate with the chemist by meeting him half-way. An encouraging atmosphere should be provided. Appreciation needs to be developed to the point where it is recognized that technology, quality control and research are essential to staying in business in these competitive, fast-moving and challenging times.

Thus it becomes apparent that the cereal chemist, with the aid of a benign management, can meet this challenge by being realistic, by finding and making constructive applications of science to industry, by eliminating the apparent inconsistencies and contradictions that creep into the work as he deals with other chemists; situations, which frequently reflect adversely on the profession and mitigate against the opportunity and the recognition chemists seek.

**Lack of Progress Apparent**

Cereal chemists have not applied themselves too well along these lines. Some progress has been made when, after some prodding, they formally recommended the 14% moisture basis for reporting the analytical factors in a flour analysis Another example of a significant contribution has been the institution of the Southwest Cereal Chemists Crop Reporting Committee. A third, and more recent instance, is the Prepared Mix Symposium which is being expanded on a national scale.

We may have lost sight of a bit of our history and need to keep some early objectives more consciously in mind. We need to apply a great deal more initiative and energy in attaining them. With this in mind it may be appropriate to read two excerpts from the history of the American Association of Cereal Chemists which illustrate that, in a sense, we are not much further along after 36 to 42 years of practice.

The first meeting (November 9, 1910) of the American Society of Milling and Baking Technology (which later merged with the A.A.C.C.) was called because, "it had been recognized for years that the methods used by chemists and technologists to test wheat and flour were not at all uniform and that the results obtained were not comparable as between different laboratories or different operators. To eliminate this confusion and to bring about greater uniformity of methods and results" was an objective for banding together to act in concert.

The first published statement issued by the American Association of Cereal Chemists after it had been formed May 8, 1915, read in part, "In the course of their experience, each one had been faced with the question: 'Why can't you chemists agree on your reports?' It must be acknowledged that there are grounds for such queries, and that, though they are explainable to the satisfaction of the chemist, it does not eliminate the fact that it lowers the value of a chemical analysis in the eyes of the baker, jobber or miller." This attests dramatically to the observation that while in general "tempus fugit," there are instances where time appears to stand still.

**More Attention to Applications**

Much discussion has been devoted to the expressed desire to allocate more time in our annual meetings to the applications of cereal chemistry. This would seem reasonable in achieving balance and becomes almost expedient when thought is given to what cereal chemists need to do, individually and collectively, to discharge the obligations that go with the practice of the profession.

As just one example from among several, let us consider the challenge presented to cereal chemists by flour specifications for white pan bread. Here indeed, is an area in which order must be brought from chaos. It is so fundamental to trade between millers and bakers as to warrant high priority in our thinking. Any constructive progress made will contribute importantly to the attainment of uniform flour attuned to the bakers needs.

Reactions to the proposal to bring this subject under scrutiny vary from a consensus that it is pertinent and timely, to the observation that some attendant conditions make the cereal chemist look foolish and the omnipresent contention that it can't be done.

Some have expressed the opinion that standardization of methodology is not needed and others fear that standardization would discourage continued research for better methods. In some quarters there is a reservation that flour specifications will tend to standardize bread while still others say that specifications can not provide for all baking conditions. I am encouraged by those who say the job needs to be done and I am goaded by those who say I will be butting my head against a stone wall.

By way of assurance, it should be said that what is envisioned in the challenge being presented, is the establishment of a framework or pattern within which the individual will have latitude in the selection of factors and ranges pertinent to his peculiar requirements, but simplified and organized by accepted methods generally used, so that we can communicate with one another coherently and trade on a rational basis.

What factors are involved in flour specifications for white pan bread? After canvassing 29 prominent cereal chemists in the baking, milling and consulting fields, I have arbitrarily listed the factors mentioned in the approximate order of frequency of mention.

**Major Factors**—Ash, protein mixing requirement, malting treatment, baking test.

**Intermediate Factors**—Absorption, color, moisture, oxidation requirement.

**Minor Factors**—Extraneous matter extensibility, machinability, flour grade.

What is the significance of these factors and what is the status of methods for each?

**Ash Test Questioned**

It is said that ash is used as an index to control flour grade; it is a check on uniform milling for a given mill and a milling guide to the miller. It is also an index of wheat uniformity. It is used as a basis for trading in flour and is presumed to be a check on the economic value of flour. If it correlates with baking performance it does so only in a very general way. It is contended that the emphasis placed upon it in some quarters is not warranted and that where applied outside the individual mill, a reasonable range should be tolerated.

There is no pressing problem in connection with methodology and concordance of results. We may there-

(Continued on page 14a)

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# Fifty Years a Miller with the Same Company

*Thomas G. Cecka, General Milling Superintendent for the International Milling Co., Started Work as a Sweeper When He Was 13 Years of Age*

FIFTY years in milling is an enviable record achieved by only a few millers. Fifty years in milling, and all 50 of those years with the same organization is an outstanding record achieved recently by Thomas G. Cecka, general milling superintendent for the International Milling Co.

Mr. Cecka started with the company in 1901 at New Prague, Minn., when he was but 13 years of age. He spent his mornings as a sweeper and in helping to cooper boxcars; in the afternoons he helped with loading and trucking. His wages were 50¢ for a 10-hour day—as compared with with a minimum wage of 75¢ an hour today.

A year later, he moved into the mill to become a full-time sweeper. To earn extra money, he put in overtime making barrels in the cooper shop, and sometimes packed feed.

Working his way through the usual milling classifications of oiler, machine tender, smutter, etc., ambitious young Tom Cecka moved upward. In addition to putting in a 10-hour day, he studied at night, working on correspondence courses to learn more about the craft he had chosen.

Mr. Cecka's 50 years as a miller, all of them with one organization, has enriched his memories. One of his memories concerns the time in 1904 when he was just beginning to find his place in milling and had to make a choice beteween it and his avocation—a musician in New Prague's Bohemian Boys Brass Band. The band, which included other employees of the New Prague plant: Rudy Kamish, John Wacek, Mike Kallal and Tom's brother, became popular but their playing engagements were interfering with mill operations.

Finally the milling superintendent, Tom Sopher, told the young miller-musicians, "You cannot serve two masters; it must be either the mill or the band." Mr. Cecka chose the mill; his brother chose a musical career, and both men stayed with the crafts of their choice.

In 1908 Mr. Cecka was promoted to trick miller at New Prague. Since shifts were not rotated at that time, he worked for eight years on the night shift. Mr. Cecka holds the distinction of being the first trick miller developed from one of the company's own milling crews.

Later, when the company purchased a mill at Sioux City, Iowa, Mr. Cecka left his duties at New Prague for several months to work with Mr. Sopher in renovating the newly acquired plant. Upon completion of that job, Mr. Cecka was appointed head miller at the company's Blue Earth, Minn., mill. This was his first assignment at head miller and, again, it was another "first," for Mr. Cecka was the first "company-developed" superintendent.

**The picture above was taken in the International Milling Co. office and shows its general milling superintendent, Thomas G. Cecka, in a moment of relaxation.**

In 1923 Mr. Cecka was transferred to New Prague as head miller, and in 1927 he was sent to Buffalo, N.Y., to advise on the finishing touches to the International organization's new plant there. He remained in Buffalo until 1937, when he was brought back to Minneapolis to become general milling superintendent.

When Mr. Cecka took over the general superintendency, the company was operating 12 plants. During the years he has been general milling superintendent, he has had a part in building five new milling units and in evaluating and reconditioning other properties which the company acquired.

An official of the International company, in commenting upon Mr. Cecka's career with the firm, said, "Milling is not an exact science but Tom Cecka mastered the basic principles and theories of milling grain to become a leading figure not only in our company but among millers everywhere. During the period when milling industry progressed from judging flours exclusively by color on the slick to present-day methods of controlled testing and exact flour gradations, Tom Cecka has been regarded as an authority on all phases of milling.

"In his 50 years with the company, Tom Cecka has seen our milling facilities grow from a small group of country mills until today we are the second largest milling company in the world. As International Milling Co. has increased in stature and importance, so, too, has Tom Cecka. The company has been fortunate indeed in having a man of Tom's ability—a man who looked into the future, saw the need for expansion and continued change in milling techniques, then went ahead to do something about it."

In an article published in "The Grist," International Milling Co. publication for its employees, Mr. Cecka expressed his gratitude to all of his associates who honored him with a dinner. "It gives me pleasure on my golden anniversary to look back 50 years to see what made all this possible," he said. "There must be a reason. After careful study, my conclusion is that I've never had the opportunity to quit. My first job was starting at the bottom and working up to my present capacity, without ever having asked for a better job than the one I was holding.

"There is a reason for that, and a simple one, too. When a young man starts out in life, he must have a job—one only. He must make up his mind to put his heart and soul into it, to feel that his job is important and that he is getting paid only for what he does and that applies to future advances.

"I belonged to a brass band in my early days and that impressed me with the importance of teamwork and harmony. Although I tooted an E flat horn—playing after beats—my position to our leader was as important as that of the soloist carrying the melody. Without teamwork there can be no harmony; without harmony there would be no audience."

Mr. Cecka said that all through his 50 years in milling, he has observed a "tremendous need for men with skill." He advises younger men in milling that promotion does not come as a matter of routine, but is based entirely upon personal conduct and ability.

"You must learn to be vigilant, punctual, honest, cooperative, and have respect for your superiors," is his advice. "Try doing just a little bit more than you have to. Keep your eyes open and your mouth shut. And, last but not least, don't ever try to tell your superior how much you are worth."

Mr. Cecka's own career, from sweeper to the position of general milling superintendent, bears out the soundness of his advice to young men.

He is possessed of an analytical mind and certainly is not one of the "it can't be done" type of millers who, through a lack of initiative and imagination, is content to accept milling as it was taught to them. Mr. Cecka's interests center in research and experimentation and cleaning and conditioning of wheat for milling has received considerable study from him.

Twenty years ago he made a statement to the effect that he believed that progress in milling technology would be along the lines of simplified milling systems with fewer but more efficient machines that would enable millers to make better flour, and have better control of the finished product.

"This applies especially to our wheat cleaning system and conditioning of wheat at the first break rolls," he said. "Wheat is the miller's raw material and yet in this category lies most of our guesswork. We have a very efficient chemical analysis on our finished products, taking the industry as a whole.

"I am looking toward the day when we can reach a degree of efficiency equal to our chemical analysis on the wheat to our first break rolls," he added in his statement 20 years ago. "That would remove most of our troubles at the source. It would catch them before they have a chance to develop into troubles."

Examination of the progress made over the past 20 years would indicate that Mr. Cecka knew what he was talking about.

The Cecka's have three sons—two of them allied with the grain processing industry. Methodius "Tody" Cecka is a sales engineer with the Hart-Carter Co., Minneapolis, while Edward is sales manager of the S. Howes Co., Silver Creek, N.Y. The third son, George, is a captain in the U.S. Army.

**Charles Ritz, president of the International Milling Co., is shown admiring the diamond-studded 50-year service pin presented to Thomas G. Cecka, general milling superintendent of the company.**

**CONGRATULATIONS!—Atherton Bean, executive vice president of the International Milling Co. (left) gives Thomas G. Cecka, general milling superintendent of the company, his warm congratulations along with a diamond-studded 50-year service pin of the International firm. The presentation took place at a dinner held by the company in honor of Mr. Cecka's service record.**

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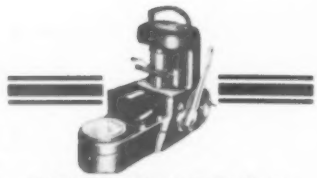
## Worm Gears

Most mechanics know that a worm, which is an integral part of a worm-gear layout, is made of a blank cylindrical in form, which has deep threads cut into it in the form of a helix or screw. To operate properly, a worm and worm gear should be ordered together, from the same manufacturer. A worm of this general type may be used to operate a worm gear which has teeth cut straight across its face, at a milling machine or otherwise.

Worms may be made with single, double, triple, or quadruple threads. Other things being equal, a double-thread worm will revolve the worm gear twice as fast as a single thread, a triple-thread worm will revolve it three times as fast, etc. The amount of horsepower that may be efficiently transmitted with a given worm gear layout does not depend on the strength of the teeth as much as on the abrasion or wearing factor. It is usually best to keep worm diameters as small as consistent, and other things being equal, it is better to use a multiple-thread worm than one of single-thread type

The worm gear layout has one great advantage in design over all others, in that any mechanism to which such a drive is applied can never be made to run backward because of an existing load. In other words, a worm drives a worm-wheel readily, but the worm-wheel simply cannot drive the worm. Using such a layout on a handpowered hoist, as a case in point, the weight of the load can never spin the mechanism and crank backward through gravity, endangering an operator. The load must be lowered deliberately and purposely, if at all.



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# Preventive Maintenance for Motors

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ELECTRIC motor builders have done a remarkable job in perfecting the design of one of the most efficient machines known today. Motors will operate under more severe conditions, more frequently, than any other piece of mechanical equipment, and with a minimum of attention.

Systematic motor care and some understanding of the causes and cures of motor ailments, however, are necessary if shutdowns are to be minimized and costly repair bills avoided. A schedule of preventive maintenance should be set up and carried out as regularly and thoroughly as circumstances will permit, whether the plant is small or large, and whether few or hundreds of motors are involved.

Although the basic causes of motor failure are simple, and obvious to even an inexperienced worker, maintaining the operation of electrical machines should not be considered a handyman job that anyone can do without previous experience or training. Plant personnel responsible for the continued operation of electrical equipment should acquaint themselves with the causes of equipment breakdowns and measures to be taken to combat such breakdowns.

This article deals primarily with causes and cures of troubles experienced in alternating current machines, but all types of motors and generators have many elements in common for which maintenance work is fairly uniform. Insulated windings, brushes, collector rings, and bearings, vary little with motor types, and similar problems will be experienced. In the following paragraphs the "natural enemies" of an electric motor, the real causes of motor trouble, will be outlined, with suggested steps to be taken to combat these "natural enemies."

### Dirt and Dust Common Enemies

Dirt and dust are encountered in most motor installations. Dirt can be defined as matter out of place, and whatever its composition, it can be deadly to an electric motor. It is a silent saboteur that will invade motor windings, interfering with heat radiation and causing dangerous temperature rises, which hasten deterioration of insulation. It can interfere with ventilation by plugging vent spaces, and soak up harmful oil, moisture, fumes, etc. Dirt can abrade slip ring surfaces, multiplying wear and blocking full passage of current. Inside bearings, it can be as harmful as sandpaper to highly polished surfaces.

Dirt and dust are most easily combatted before they have a chance to unite with oil or moisture in a gummy, hard-to-remove mess. To keep dirt out of bearings, oil filler caps should be properly fitted and closed. Dust seals and gaskets should be kept in good condition, and replaced if they are worn or rotted. In totally-enclosed motors, a periodic check should be made to assure tight fitting joints in the motor frame and bearing seals.

In open type motors, wiping off exposed parts and occasionally blowing dust out of the wound section, should be a regular procedure. Be sure to have plenty of clean rags available for wiping off housings, cleaning slip-rings, or removing dust from other accessible surfaces. One word of caution—do not use waste. It contains lint that will adhere to surfaces it contacts.

Clean, dry, compressed air, free of grit, metal or moisture, is generally recommended for blowing out electrical machines. The pressure used for a specific job should be no more than is necessary for removal of dust and dirt without damage to the winding and insulation. Be careful not to direct the blast of compressed air in such a way as to loosen insulation, or force abrasive or conductive particles into inaccessible places. Air suction is sometimes more desirable, especially if nearby operations could be impaired by the displacement of dirt in the motor. A vacuum cleaner can be used for this purpose.

### Avoid Excess Oil

Stray oil is a close ally of dust and dirt in creating trouble for motors. Together they can form a gummy, sticky mess on motor surfaces. Without oil or grease to lubricate vital bearings, motors cannot operate, but this oil must be kept where it belongs, acting as the "lifeblood" of the motor. Otherwise, it is strictly poison in its effect on motor life.

Oil can seriously affect the insulation of motor windings. Should a winding become thoroughly oil-soaked, the motor will be in immediate danger of a burn-out or breakdown. No amount of wiping or cleaning can remedy such a situation. The soaked coils will probably have to be rewound. In any case, oil and grease should be kept away from


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windings for they will, in time, soften and weaken the insulation. In combination with dust, oil becomes a serious menace to winding life. Ventilation is smothered, and insulation is under constant attack from the oil and the excessive temperatures resulting from restricted cooling.

The fight against stray oil begins with keeping a motor's lubricating oil where it belongs. Check oil seals, well covers and plugs frequently to see that they are tight. Never lubricate ring-oiled sleeve bearings when the motor is running, because overfilling and escape of oil will probably result.

Grimy or greasy accumulations on motor windings should be removed with the aid of a cleaning agent. Non-inflammable solvents are safest to use, but pure carbon-tetrachloride is not recommended because of its deteriorating effect on varnishes and its harmful toxic effects. A solution of 60% carbon tetrachloride and 40% naphtha or lead-free gasoline is more satisfactory. However, the solution should be applied sparingly, and never be sprayed or poured on the coils. An excess can be as dangerous to insulation as oil and grease. And remember, adequate ventilation must be provided wherever carbon tetrachloride is used.

Moisture is another enemy of motor life. Excessive moisture may cause a failure in insulation which is otherwise in good condition. Electrical machines should always be protected against falling water, and the condensation of moisture on motor surfaces should be prevented by maintaining the temperature of the machine well above the dewpoint. If moisture does get into a machine, every effort should be made to dislodge it as quickly as possible. It takes time for moisture to soak and soften insulation, and it may be possible to remove it before the damage is done. In addition, water has the ability to absorb harmful compounds and become an active agent of destruction, and the more quickly it is removed, the less opportunity it has to exercise this capability.

Precautions against moisture are simple enough. Motor manufacturers have developed designs with varying degrees of enclosure — drip-proof, splashproof, totally enclosed, etc.,— but all motors should be guarded against the accidental entry of water from drip and splatter. Running standby motors a little, at least once a week, can help to guard against moisture condensation during idle periods. Electric space heaters, mounted either below or within the machine, can be utilized during shutdown periods to keep the machine temperature safely above the dewpoint, and protect the motor most effectively from the condensation of moisture on interior parts.

Insulation resistance tests are used to determine whether or not moisture has produced a harmful condition in the motor. When resistance has dropped to a dangerous point, the motor should be dried out by the application of heat until the resistance becomes constant and sufficiently high. The temperatures maintained during this period should not exceed the following:

Class A Insulation—
by thermometer 170° F.
by resistance or detector 185° F.
Class B Insulation—
by thermometer 185° F.
by resistance or detector 200° F.

The heat should be applied slowly at first so that the final desired temperature is not obtained too rapidly. The heat is then regulated to maintain the proper uniform temperature. The insulation resistance should be measured before the heat is applied, and periodically thereafter. The interval between checks may vary with the rate of drying and the convenience of making the measurements. The insulation resistance will decrease as the machine warms up, but will increase as the dry out process continues. When the readings reach a common value, and are sufficiently high, the drying out process is complete, and may be discontinued. In order to obtain constant readings, a uniform temperature must be maintained in the machine.

**Removing Moisture from Insulation**

Various methods of removing moisture from insulation have been used: external heat, internal heat, or a combination of the two. For the first method, external heat, an oven is the most practical medium. Too tight enclosures or covers are undesirable, as ventilation is required to remove the moisture-laden air. Electric or steam heat with some form of temperature control can be used safely.

Other measures for the application of external heat can be used, depending on circumstances. A fan, blowing heat from hot elements, such as resistors, steam pipes, etc., can be used to direct heat into the motor windings. Or the motor can be covered with non-inflammable materials, and heat directed to it through ducts. In still another variation, the motor can be covered with a tarpaulin—leaving vents at top and botton for circulation—and heat provided by electric light or infra-red heat lamps.

Internal heating is more often used with larger machines where an oven or enclosure is impractical. In any type of alternating current machine, an external source of current can be utilized to circulate direct current

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through the windings. A portable low voltage motor-generator set, such as is used for welding, is suitable. Stator phases may be connected in series or in parallel to suit the available power supply if both ends of all phases are accessible. If only three leads are brought out of the machine, the current may be circulated between one terminal and the other two connected together. The temperature of the single lead connection must be checked frequently, and it is desirable to shift the leads occasionally.

Alternating current can be used on the stators of synchronous and squirrel cage induction motors if the rotors are removed. Wound rotor induction motors may be dried out on alternating current with the rotor in the stator, blocked to prevent rotation, and the collector rings short-circuited. However, alternating current is usually not as easy to use as direct current. It is often more difficult to obtain the required voltage control, and alternating current requires a higher voltage source. In addition, care must be taken that parts adjacent to the winding, such as rotor bands, lead studs, core supporting members, etc., do not overheat due to induced currents and the lack of normal ventilation.

The brushes must never be used for circulating current in the rotor of any type of machine when the rotor is stationary. The leads should be firmly clamped to the collector rings.

Whatever method is used, care should be taken that the drying is accomplished without damage to the insulation. When dry, the resistance of the motor to moisture can be renewed by applying a good grade of insulation varnish. Remember for continuous, uninterrupted service, it is essential to keep motors dry by preventing or removing accumulated moisture.

**Proper Lubrication Essential**

Friction is a mechanical problem, familiar to machine operators everywhere, and precautionary measures to combat it are easily understood. The key to anti-friction maintenance, logically enough, is proper lubrication. Overloaded, or mistreated bearings can deteriorate in a matter of seconds. The oil film protecting a bearing from wear is often microscopically thin, no thicker than the wall of a soap bubble, and if the pressure on this film becomes too great, this film can fail as suddenly and completely as a bursting bubble, resulting in metal-to-metal scraping and bearing failure.

Theoretically, no wear can take place within a bearing if the surfaces are smooth and adequately lubricated. A film of oil then keeps them apart, and prevents metal-to-metal contact. In actual practice, though, bearings often receive too little oil, or the wrong oil, or grit gets into the oil and produces scraping, or the load on the bearing is so great that the film of oil breaks down.

A primary rule in fighting friction is to follow the lubrication instructions given by the motor manufacturer, specifying the type and grade of lubricant, the frequency of lubrication, etc. The operator should never guess at the grade and type of oil or grease. Only a lubricant of the best quality and correct grade suited to the requirements of each individual motor, should be used. If in doubt, contact the manufacturer or his representative.

In horizontal motor design, ball bearings, roller bearings, or sleeve-type bearings are used. The type depends upon the application of the motor, i.e., the nature of the driven machine, how power is transmitted from motor to machine, shock and noise limitations, position, exposure to water or dust, accessibility for servicing, etc.

Sleeve bearings on larger motors are split at the horizontal centerline to facilitate assembly and inspection. In small integral- and fractional-horsepower motors, solid bronze or babbitt-lined shells are used. In split sleeve bearing construction, babbitt, bonded to the bushing shell, and accurately bored to insure uniform clearances, provides the bearing surface.

Ring-oiling is generally used as the most simple and reliable method of delivering oil to split-sleeve bearings. The bearings are fed with circulating oil, "pumped" by the rings riding on the revolving shaft. The rings dip into the oil reservoir and carry oil to the top half of the bearing. Oil is fed by gravity into the lower half of the bearing where the load is carried. The excess oil, as it flows back into the reservoir, helps to carry heat away from the bearing.

Oil rings should be checked periodically to make sure that they are functioning properly. Inspection covers are provided in bearings for this purpose. If the ring is not turning freely, check for:

(1) Ring out of round from mishandling.
(2) An offset at the ring joint.
(3) Ring fouling on a projection or rough spot on the bearing casting.
(4) Nicks or rough spots on ring faces.
(5) Ring unbalanced. (The heavy side will remain down).
(6) Adhesion of ring to guide slot through oil film.


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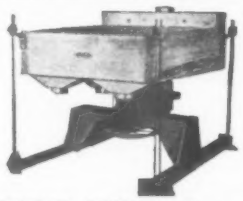

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(7) Oil too cold, or too viscous.

The oil level, with the oil at operating temperature, and the machine not running, should be within one quarter inch of the top of the oil cup, or of the correct oil level when indicated on the machine. Oil should not be added to the reservoir of a sleeve type bearing while the machine is running, because it is unlikely that the operator will obtain a proper reading of the true oil level. Due to rotation, the oil ring tends to pile up oil on one side of the reservoir and lower it on the other. An overflow of excess oil could enter the motor enclosure and endanger the life of the windings, as previously discussed under "Stray Oil."

To insure long life in sleeve-bearings, sufficient oil of good quality, free of foreign matter, should be provided. Ring oiling systems possess a natural advantage in that the flood of oil passing through the bearings tends to wash away any grit, dirt, dust, or metallic particles that may have gained entry, into the reservoir where they can settle out of circulation.

Before a machine is placed in operation, any oil piping should be flushed. After the first few days of operation, it is advisable to remove the oil and refill with fresh or filtered oil. This should be repeated at intervals of six months to one year, depending on the amount of service, cleanliness, speed, and temperature of the machine. Oil should be examined periodically for signs of deterioration or sludging. Sludge can block bearing passages and cause failure of the bearing.

**Anti-Friction Bearing Maintenance**

Motors with grease-lubricated anti-friction bearings—ball or roller—are generally shipped from the factory with the bearings packed with grease and ready for operation. Maintenance problems are simplified because manufacturer's instructions, which should be included with the motor, include the quantity and type of oil or grease best suited for proper lubrication, with suggestions for servicing the bearings.

In addition to anti-friction lubrication, the lubricant in ball or roller bearings must also guard the steel rolling elements and races from corrosion. For this reason, it is especially important that the manufacturer's recommendation be followed when renewing the bearing grease.

One charge of grease in anti-friction bearings may last a year under normal operation, but since all greases deteriorate in time, the condition and quantity of the lubricant should be checked at least once every three months. Once a year the bearings and closure parts should be dismantled, and the old grease removed. Kerosene or carbon tetrachloride can be used to flush the bearing. Repack with new grease when reassembling the bearing. Remember—never fill the bearing cavity more than half full of grease. Too much grease in bearings promotes friction and heat, and the excess may be forced past bearing seals and into the motor windings.

Users of ball bearings in motors are cautioned against pounding or bumping on pulleys, couplings, or sprockets, in a manner which will transmit the shock to the bearings, as ball bearings are easily injured in this manner. Avoid undue pounding, also, in dismantling or reassembling the motor. In belt or chain drives, avoid needless extra tension that could overload bearings.

Misalignment can be the cause of sprung or broken shafts, burned out bearings, overload failure, or other motor damage. And the damage can also occur in the drive, or in the driven machine.

Couplings, pulleys, pinions, etc., should be carefully checked for alignment at the time of installation, and at intervals during the period of service. Settling of foundations, heavy floor loading, excessive bearing wear, and other factors can disturb alignment. Even a motor and machine combination on a common steel base is not proof against misalignment, as the base itself may have warped from off-level mounting. The push-apart tendency of spur gears, too, can disturb alignment, and should be checked occasionally.

There is no middle ground about misalignment—either the equipment is in line or it is not. In belted drives, the driving and driven sheaves should be lined up in such a way that the belt runs on the center of both pulleys without disturbing the free oscillation of the motor rotor. Pulleys, pinions, and sprockets should be mounted as close to the motor bearing housing as possible, to reduce shaft distortion to a minimum.

Coupled drives should also be aligned carefully, if a broken shaft or ruined bearing is to be avoided. Real success in coupling alignment depends on keeping both driving and driven shafts in a straight line. A variety of "flexible" couplings is now on the market, and the manufacturer's instructions should be followed for their alignment. Solid couplings should be checked carefully at assembly, and bolts holding the two halves together should be inspected periodically, and tightened if necessary.

Misalignment sometimes gives a warning. Excessive temperature may warn that it is causing overload in the motor or bearings. Increased vibration may be the warning signal. Or a rapid knocking may warn that the shaft is being driven against a bearing shoulder.

It is sometimes possible to realign the motor and its drive while the set is in operation. With mounting bolts loosened, variations in position of motor and drive can be tried until the symptoms disappear and the set is in line. Shims can be used under motor feet to level it up with the driven machine.

Excessive tension in belt or chain drives can also be considered as a factor in misalignment. Belts require a certain amount of tension to start and pull the load without slip, but too much tension will overload and damage bearings on both the motor and driven machine. Vibration can shake the life out of a machine, electrical or otherwise. It is sometimes a result of misalignment, but other causes, too, should be considered. A driven machine may be the source of vibration that is being transmitted to the motor. Or the culprit might be an unbalanced condition in the motor rotor, loose holding-down bolts, non-uniform air gaps, or worn bearings. Whatever the cause, vibration is a serious enemy that can shake loose mechanical parts or electrical connections. It can cause metal fatigue, or it can greatly increase frictional wear.

Assuming that proper alignment has been achieved, the source of vibration can best be determined by a process of elimination. Checking the possible causes of vibration in the order listed below may determine the source:

(1) Check the motor for loose parts,

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and tighten all holding-down bolts.

(2) Compare the foundation for solidity with that of non-vibrating motors.

(3) Check bearing clearances. Bearing wear to the extent of two or three times the original bearing clearance will not impair operation provided the correct air gap is maintained and the bearing seals are adjusted.

(4) Operate the motor alone, disengaged from the drive or driven unit. It may be that the vibration is caused by forces outside the motor itself.

(5) Check rotor for unbalance. This should not be necessary unless repair work has caused unbalance. Motors leave factory with rotors in balance.

**Slip-Ring Motors**

Uneven wear of slip-rings and brushes is a maintenance problem where synchronous or wound rotor induction motors are used. It is impossible to eliminate wearing of these parts, since no effective lubrication can be applied to reduce the friction between brushes and rings. What is important is that every effort is made to keep this wearing under control.

Certain conditions will lead to grooving of the slip-ring surfaces in narrow rings or ruts. The abrasive nature of dust can hasten brush wear of ring surfaces and cause grooving. As previously noted, all motor parts should be wiped free of dust at regular intervals. Care should be taken to keep an oil film from collecting on the rings, where it can both accumulate dust and prevent proper contact with the brushes. Surface irregularities can result from uneven oxidation on the rings if brushes are left in contact with rings during prolonged shutdown periods.

Normally, satisfactory operation of rings and brushes can be obtained by meeting the following conditions:

(1) Brushes must be properly seated to make full contact with rings, and should not override the edges.

(2) Brush pressures recommended by the manufacturer should be maintained.

(3) Brushes should be of the correct grade for the application.

(4) Brushes must be free to move in holders.

(5) Rings must be kept clean of dust and oil.

(6) Brushes should be lifted from ring surfaces during prolonged shutdowns.

(7) The motor, itself, must be operating within its rating.

Motor shafts should be free to float axially, spreading wear over a wider area on the ring surfaces. Belt drives should be so aligned that such axial movement is not hampered. Rough or uneven ring surfaces should be remedied as soon as possible. If this is neglected, wear will be increasingly rapid, grooving and pitting will take place, and excessive sparking will result. Resurfacing can often be done without removing the rotor or the rings, by running the rotor in its own bearings, using an abrasive stone secured in a suitable holder. Care should be taken during resurfacing to keep abrasive dust from entering the motor windings. Hand stoning should not be attempted, as it may exaggerate and enlarge surface irregularities.

Brushes, too, can be worn unevenly, and in themselves contribute to excessive wearing or grooving of slip rings. If such a condition exists, the brushes should be properly seated to the correct arc, or replaced with a new set. Manufacturers of slip-ring motors generally advise that a complete set of spare brushes for each motor be kept on hand for speedy replacement when necessary.

**Do Not Overload Motors**

Overload of motors beyond rated capacity will cause them to heat up excessively, and eventually breakdown or burn out. Motor manufacturers provide a margin of safety by rating the capacity of motors below the actual breaking point, but this safety factor should never be jeopardized by deliberately causing a motor to carry too great a load.

Overloading is not always intentional. It can be produced accidently by misapplication of the motor design, by obstruction in the drive or drives, by excessive friction in the motor, or by trying to obtain greater output from the driven machine than the motor can carry. Any of these conditions can make the motor current exceed its nameplate rating, with a heat rise that may be as much as the square of the current increase, causing burned out bearings, deteriorated insulation, or melted solder connections.

Overload protection in the power circuit to the motor can prevent damage to the machine itself. Generally, a thermal element operates an overload relay, or a fuse in the circuit blows out, when heated excessively, to open the circuit. For continuous production, however, it is better to guard against the conditions that cause overloading.

**Schedule Electric Motor Maintenance**

Maintenance of electric motors, watching for symptoms of these basic causes for motor failure, should be


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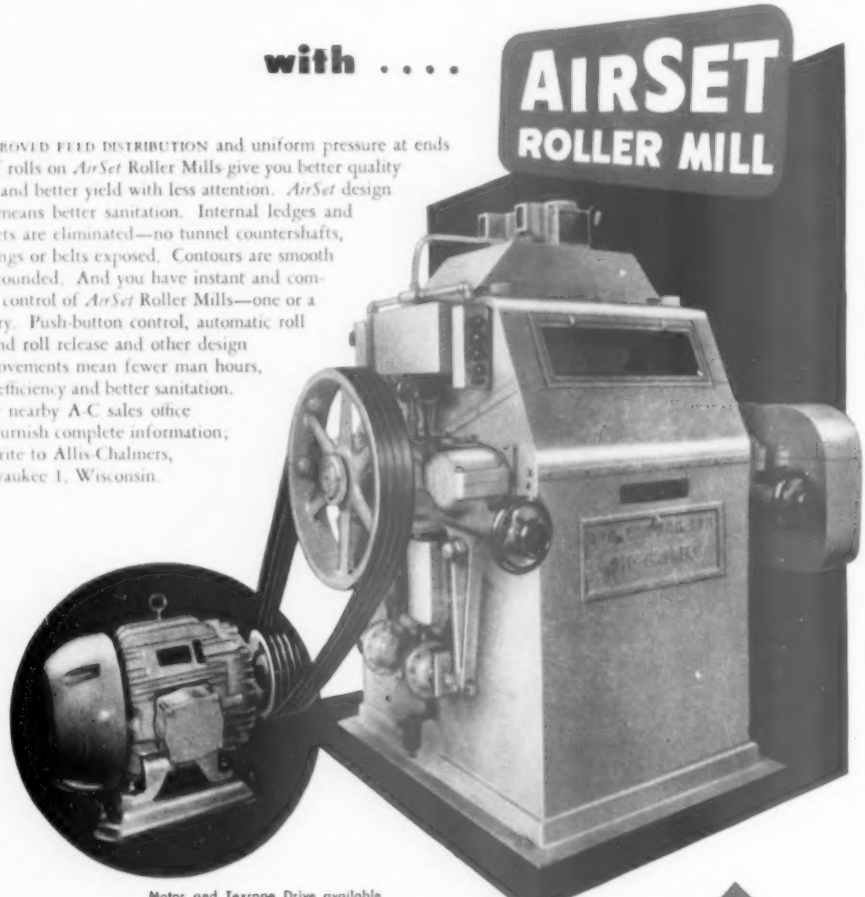

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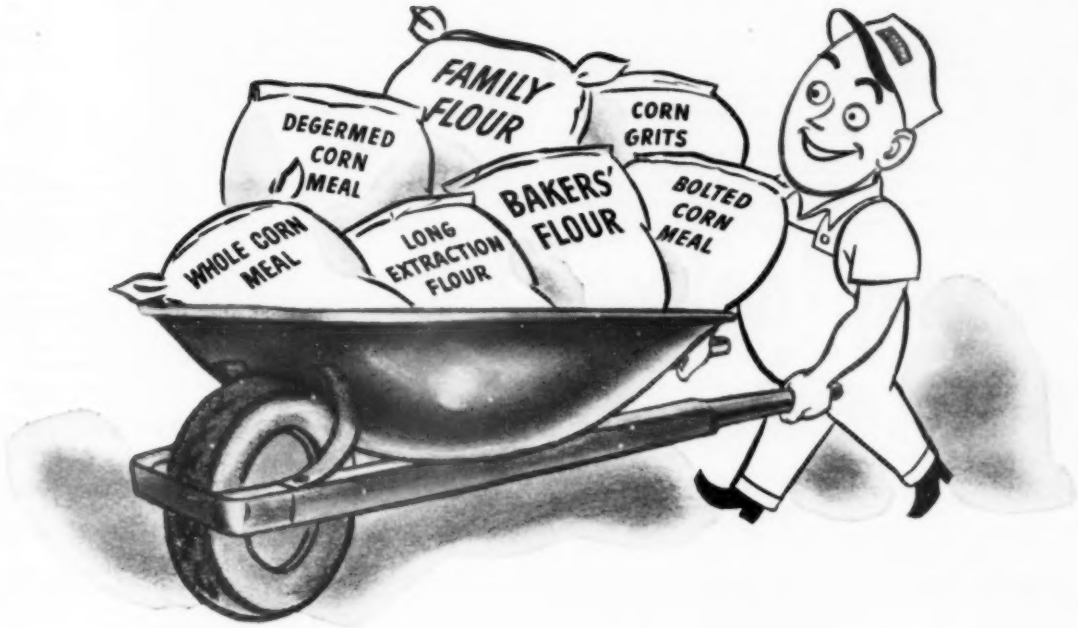


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carefully planned, and systematically carried out. Maintenance schedules should be tailored to fit plant requirements as determined by careful analysis of problems involved. A typical schedule would include most of the following:

Weekly inspection—check surroundings for any unusual conditions that might jeopardize motor operation.

Check for unusual noises, such as might be caused by metal-to-metal contact, or for odors that might indicate excessive heat.

Check motor and bearing temperature with the hand.

Check for excessive sparking of brushes. Check brushes for wear. Check pigtail connections.

Check for dirt accumulations on motor. Wipe off motor parts. Look for evidence of moisture. See if any oil or grease has worked past bearing seals.

Check oil level on sleeve bearing motors, and refill if necessary. See that oil rings are rotating properly.

Monthly inspection—check brushes for fit and free play in holders. Check brush-spring pressure. Replace worn or damaged brushes. Examine slip-ring surfaces for unusual roughness.

Check for oil leakage on all bearings. Look for signs of excessive bearing wear. Check oil for evidence of dirt or sludging, and clean out oil reservoirs if necessary.

Check belt drives for slack and surface conditions. See that belt runs steadily and close to motor edge of pulley.

Check loads for changed conditions, poor adjustment, or improper handling.

Annual or biennial inspection—check air gap with feeler gauge.

Check insulation resistance. Examine insulation surfaces for cracks or excessive brittleness.

Check all bearings. Repack grease-lubricated bearings (at least once a year). Replace defective bearing parts.

Check squirrel cage rotors for loose or broken bars, and for evidence of local heating. Check fan blades for looseness.

Check and clean collector rings, washers, and connections on wound rotor induction and synchronous motors.

Check and clean thoroughly all motor parts and ventilating spaces.

Check belt drive for possible replacement.

Alertness to unusual conditions that may be the first signs of motor ailments can prevent a great deal of trouble. It pays to be on the lookout for the common trouble symptoms which have been discussed here. And remember—if time and facilities to effect adequate motor servicing are not available in your plant, consult a reputable motor service shop. It is cheaper to take care of your motors than to replace them.


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## Are You Prepared to Supply Proof of a Fire Loss?

### By H. G. Hiller

THE annual fire loss in the U.S., according to latest published statistics, is running somewhere in the neighborhood of $700 million. Available reports also indicate that in a large proportion of the loss adjustments, the properties are found to be substantially under-insured with the result that many properties are not rebuilt after a loss, or if they are rebuilt, the owners are forced to make a substantial additional investment to enable them to remain in business.

Most of these losses due to under-insurance could have been avoided had the property owner taken steps before the fire to make sure that the property was adequately covered. Sometimes the property owner recognizes the precariousness of his position but defers action until too late. As an example, we quote from a recent issue of the Underwriters' Report the following:

"(The) fire on Jan. 30, 1950, has recently been settled with the final loss payment totaling $169,885. . . .

"Insurance in force on the buildings and equipment was based on a 1946 appraisal . . . and inasmuch as reappraisal and readjustment of insurance had been planned but not made, the winery had become a co-insurer . . .

"Adjusters for the insurance company were given the 1946 appraisal to start with. To arrive at current value, they increased the replacement value of all the destroyed portions of the plant as well as the non-destroyed portions.

". . . after deduction for the co-insurance penalty, the amount mentioned above was agreed upon."

In contrast to the above is the case of a realty company which recently authorized a detailed appraisal of one of the commercial buildings which it owned. Upon receipt of the appraisal report, this company promptly increased its insurance from $100,000 to $150,000. Shortly thereafter a fire occurred which destroyed the building. The Adjustment Bureau conceded the fact that the building was a total loss and paid $150,000.

Under-insurance is frequently due to the failure of the property owner to recognize the facts clearly stated in the insurance policy that a loss is

settled on the basis of the "actual cash value" at the time of the fire. For lack of better evidence, the property owner may base his insurance on his book values with some general upward adjustment in recognition of the increase in building and equipment costs. In arriving at his estimate of insurance coverage, he may fail to take into account the following facts:

1. That the book costs represent the capitalized costs only and do not include the cost of many minor items such as piping, wiring, installation of machines and improvements made with plant labor, which represent a part of his insurable value.

2. That the property has been over-depreciated on the books—often as much as 50 or 60%—and that, based on the actual condition of the property at the time of the fire, the depreciation should be much less.

3. That there has been a much greater increase in the cost of buildings and equipment than he had realized. The American Appraisal Co.'s construction cost index was 486 in February, 1950 (based on 100 for 1913), compared with 150 in 1933 and 200 in 1939.

The resultant under-insurance arises from the use of general estimates where specific and definite information is sorely needed.

**When a Loss Occurs**

After having reached a decision as to how much insurance to carry, the average property owner dismisses the subject from his mind. He may not think about it again for several years, although he is aware of the fact that the costs of buildings and equipment are steadily increasing.

When a disaster occurs, he may for the first time discover just what is required of him in reference to notifying the insurance company, protecting the property from further damage and submitting a proof of loss. These provisions are set out on lines 90 to 122 on the reverse side of the standard fire insurance policy. If he was not already aware of it, he will discover that in connection with his proof of loss, he must submit an inventory of each and every item destroyed or damaged, with complete descriptions and specifications and setting forth the "actual cash value" at the time of the fire.

If he does not have such an inventory before the fire, he will find it extremely difficult to prepare it after the fire.

Of course, losses are settled where no such property record is available. But without a detailed record of the property showing its description, condition, location and present "actual cash value," differences of opinion are likely to arise between the insurance adjusters and the property owner as to the amount of his loss and the adequacy of his insurance coverage. This lack of specific information operates against a prompt and satisfactory adjustment of the loss.

**Appraisers Appointed**

In case the property owner and the insurance adjusters cannot agree, lines 123 to 140 clearly state the procedure to be followed. This involves the employment of appraisers by the property owner and by the insurance company which involves considerable expense and, what is likely to prove more damaging, further delay in the settlement.

If the appraisers so appointed cannot agree, the matter is then referred to a third party who acts as umpire and this involves additional delay.

At the time of a loss, promptness in the settlement is of utmost importance to the property owner. If the loss is a serious one, his business is at a standstill and his customers are going elsewhere. He cannot rebuild his plant until the loss is settled.

If he has had the foresight to obtain a detailed inventory and valuation of his property and keep it up to date to reflect changes in the property itself and changes in the condition and in the price levels, the availability of such a record will greatly facilitate the prompt settlement of the loss.

The value of such a record prior to the loss cannot be measured alone in the dollars recovered as the time element itself is of such great importance.

A prudent management will proceed on the assumption that since a fire may occur at any time, it is wise to be prepared for it at all times. The cost of having such a record prepared and maintained should be considered as a part of the cost of an adequate insurance program.

Fires and other property disasters may result from internal or external causes.

Among the internal causes there are such things as faulty wiring, electric sparks, dust explosions, boiler explosions and carelessness on the part of employees.

Among the external causes are fires starting in adjoining properties, lightning, windstorm, falling air craft, external explosions and many others.

It is well, therefore, to be prepared in advance for the adjustment of a fire loss, to make sure that the property is adequately covered by insurance, and to be sure that you are in a position at all times to furnish on short notice the property inventory and valuation which is required of you in the preparation of a proof of loss.


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## Flour Specifications

(Continued from page 1a)

fore pass on to the next factor with the observation that some improvement in concordance on ash tests can be made when operators more generally take greater pride in a job well done.

In the minds of many, protein content is secondary to baking performance. This implies that protein quality is a factor, not yet satisfactorily defined. It would seem that in its commercial application at least, protein content has been overemphasized so that the purpose of ascertaining this factor is not so much a question of level as of uniformity. It follows, as experience has demonstrated, that adjustments can be made to whatever the crop offers. It permits advocates of high protein and low protein to exercise selectiveness within the general framework already referred to. It involves the evaluation of protein content in relation to absorption, yield and shop conditions of processing.

As in the instance of ash, for miller and baker, it is another index of uniformity, in the wheat and in the flour and is determined for economic reasons whenever premiums on protein content are applied. The indications are that a reasonable tolerance range for this factor in flour specifications would be 0.5%.

Methodology in this case too offers no problem other than the greater concordance that comes from the hands of a proficient, meticulous operator assuming that other factors such as sampling have been provided for.

### Mixing Requirement of Flour

Mixing requirement is becoming an increasingly more pertinent factor in defining a flour. Off-hand, I would estimate that 70% of the job of making uniformly good bread by the sponge and dough method under commercial conditions is related to the proper adjustment of the physical characteristics of the dough. Besides, as shops become more intensively productive, it becomes important to have an upper limit on mixing requirement if an established schedule is to be maintained.

This latter observation is a caution not to go too extensively into long mixing wheat varieties either in production or in wheat improvement programs. It would be sounder practice to maintain a range on this and other factors so that individual requirements can be met by utilizing the device of blending to achieve a desired end. Again, within the framework, there will be left room within which the proponents of long mixing or short mixing and varying degrees of tolerance to mixing can exercise their options.

But what is the situation with regard to the methods used for measuring this factor? Here we enter an area needing attention! The trend is in the direction of using the Farinograph. Some use the baking test with differential mixing times and only a few use the Mixograph. Many agree that an objective measure for this factor is desirable, hence the trend toward the Farinograph.

What do we find? A montage where we find in jumbled array the terms large bowl and small bowl. As to the sample weight we find that practice varies from the "as is" basis to the 14% moisture basis to the use of a constant weight of dough. The air is filled with references to valorimeter values, the M.T.I. factor, peak development, optimum development and various and sundry others!

### "Crying Need" for Standardization

Some of these again fall within the general framework to be used at the individual's discretion. In time they will need to be satisfactorily defined, but right now there is a crying need to get together on some standardized procedure for obtaining Farinograms and then study them so as to ultimately interpret them meaningfully. More discussion and collaborative study can not help but evoke ideas and crystalize thinking if for no other reason than that verbalizing and philosophizing on this subject will contribute to this end.

I am aware that some effort is being made in this direction. It should receive more concerted support at the association level, and should have imparted to it a greater degree of direction and impetus. The fruits thereof should then be formalized by being accepted as an approved method by the A.A.C.C. with the prestige and status which thus would be given to it.

Where do we stand on malt treatment? A deficiency should be avoided. Proper treatment makes for baking tolerance, adequate sponge fermentation and desirable dough characteristics for machining and for response in the early stages of baking. We are emphasizing less the effect of malt treatment on gas evolution and veering more in appreciating the effects on dough handling and the dough's response in the early stages of baking especially in connection with the sponge and dough process.

With the introduction of the fungal amylases, our concept of "malting" is boiling down to the action of alpha amylase on the wheat starch and the resultant effect on extensibility and pliability of the dough for opti-

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mum bread quality or the individual's preferred bread character.

The measurement of malting presents another facet for measuring uniformity of the flour in order to obtain a uniform response. This carries through the whole philosophy of adequate flour specifications. No one factor, by itself, is as yet adequate. Consequently, if a reasonable number of factors can be effectively defined, we stand a better chance of producing or procuring (as the case may be) a uniform product which, when subjected to consistently controlled conditions of formulation, manipulation and processing, will yield a uniform result or finished product.

Do we measure this factor so that we can communicate understandingly with one another? No! The test for gassing power is more generally used, but here we have the "dance of the hours." What shall it be? Four hours, five hours or six hours? Besides, equipment may need to be standardized more closely. The consensus is that for cereal amylases the results of this test correlate well with baking response.

Some use the baking test, but we shall pass over it for the moment and give it the attention it deserves later.

**Make Maltose Test Meaningful**

The maltose test is used to a significant degree, it seems to be reasonably satisfactory on concordance, and is valid and convenient for mill control but not desirable for general application since it does not correlate too well with baking response. Still the man speaking in terms of maltose is trying to talk understandingly with the gassing power devotee and the Amylograph advocate.

More recently the Amylograph has been adopted to measure primarily the response to alpha amylase. In this area will be found the pros and cons holding forth, each secure in his own convictions. To complicate matters it is apparent that the equipment and the method are in need of standardization. In passing, I need only mention that variation also exists due to varying practices with respect to weight of sample, water versus a buffer, and so forth.

An attempt is being made to standardize the Amylograph test but too many are looking to too few to do the job. Let us stop treating this and similar problems like a Cinderella and give to them the force and support at the association level.

Now come the fungal amylases and, were they to be used universally, all of our existent "malting" measurements would be invalidated. There is, in fact, a need to develop a measure for the fungal amylases. Will we sit on this job until it reflects adversely on us or will we accept this challenge and meet it head-on?

As individuals let us concern ourselves with this situation on "malting" tests and then collectively, take steps to recommend the methods best adapted for measuring a given factor.

The baking test represents not only another area where chaos reigns but is at the same time a highly controversial question. Nevertheless, it is so fundamentally important that it is difficult to understand why cereal chemists collectively can not get together on some measure of standardization or on a basic procedure to serve as a reference point from which to seek confirmation with supplementary tests, limited only by the individual's needs, imagination and ingenuity, provided he proceed stepwise, by an organized, scientific procedure.

The woods are full of fixed procedure proponents and advocates of the system to vary conditions to get optimum bread quality. There are the lean versus commercial formula factions and the straight dough believers as well as the sponge and dough devotees of which the last named seem to exist in greater numbers.

No further break-down of details is needed to set the scene here. It may not be amiss however, to point out that the baking test should emphasize in our minds the parallel problems that exist, namely, the methods of reporting results, establishing the limits of significance of such results and the rational interpretation thereof.

What are we trying to accomplish? Are we trying to obtain a uniform ingredient or define an ingredient's function, or to tell the baker how to do his job or predict the type of loaf a given flour will yield?

**Baking Tests Not Adequate**

No baking test can cover all conditions. Each one is but one combination out of an infinite number. On the other hand, for any given flour a baking combination can be found which will yield bread of satisfactory quality.

The primary objective would then seem to be to determine uniformity by response to a standardized and fixed procedure so that one can observe any variation in response. Until our knowledge is still further advanced it would seem to be in the interests of dependability to select a vehicle that is rather sensitive in pointing out differences or variations in the flour and at least bring the scientific, organized approach to this test.

It can well be appreciated that there is a desire to gain some knowledge as to how a given flour will act under conditions applied in the shop and what the loaf characteristics will be. This knowledge can and


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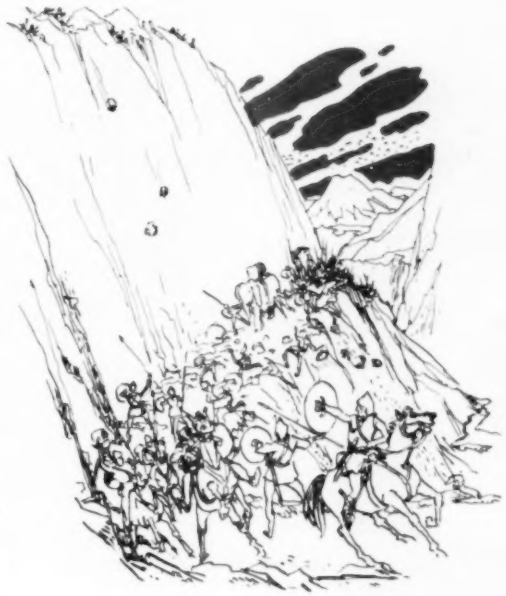

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should be obtained at the individual's discretion but supplementary to a yardstick that could be the common denominator in all laboratories. There should be no reason why each laboratory could not, in time, establish or check the correlation between the flour's response to such a method and the process or particular type or quality of bread in which that laboratory is immediately interested.

In the final analysis it comes down to whether we, as cereal chemists, want to get together and whether we are professionally mature and scientific to the point where we can put our foibles, pet opinions and prejudices in the background and converge to a working basis that will bring clarity to our work and lend greater prestige and recognition to our profession.

The factor of absorption obviously has implications with respect to physical characteristics of the dough and, within certain limits, not yet too well known and defined, to bread yield. Certainly we will want to work in the direction of an objective test. It would seem that with the Farinograph we could kill two birds with one stone and obtain an index of mixing and absorption. The first need is to standardize the test so that all of us speak the same language.

That the results may not be applied directly to commercial practice is academic. There is reason to believe, that for all practical purposes, at least correlations can be established. Thus in each individual instance the results from a standard test could be translated into shop terms.

As was pointed out, the major portion of the trick of making uniform bread of satisfactory quality lies in obtaining uniform physical dough characteristics through adequate adjustment of absorption, mixing, malting and oxidizing. Here is incentive and a challenge to cereal chemists to exercise more individual and collective initiative, industry and diligence in making the currently available tools more useful.

Time will not permit discussing the factors of color and moisture at length. They do not present any important problems at the moment. Color is observed for the most part by means of the Pekar or slick test. Many also judge this factor on the basis of crumb color.

As to moisture, if methodology varies, at least satisfactorily concordant results can be reported. It was not always so. That this factor presents no pressing problem is the result of earlier and comprehensive studies. They should serve as examples of what can be accomplished if cereal chemists will converge on a problem, minded to find a common basis from which variations and departures may be gauged.

Under oxidation requirement there have been combined such terms as maturing and bromate response. Virtually no one attempts to define this factor in quantitative or arbitrary terms. Most generally the baking test is used as a guide in adjusting it although some attempts are made to gauge it with devices like the Extensograph and the Chopin extensimeter.

This does not mean that study in this area has been lacking. Indeed, important advances have been made but the mechanisms are not yet fully understood. Consequently, we are required to proceed empirically. In most cases workers attempt to define this factor in terms of baking response, either by delegating it to the mill chemist or by adjusting to a satisfactory level by conferring with him.

Until our knowledge is advanced still more, and here remains a challenge to the research-minded, it would seem that so far as can be perceived, the influence of this factor on color, maturity, storage life, physical dough properties, yeast food practice and baking response is being practically provided for by the means just mentioned.

Some day extraneous matter as a factor may be included in flour specifications. That time is not yet here. This factor, therefore, can just as well be left for discussion at another time. Meanwhile, there exists much incentive to get this job done. In this area where no great investment of experience has yet been built up to complicate things, let us cover the work that is needed on methodology and interpretation with vigor and with orderliness. From such a background then can be drawn a rational and realistic basis for specifying this factor and to guide miller and baker.

Extensibility and machinability have not yet come into focus clearly. For the moment we are covering them in a fashion through adjustment of absorption, dough development in the mixer, malting and oxidizing, picking up the elements we cannot yet define satisfactorily by the resultant reflected in the baking test. They represent the cereal chemist's groping for more satisfactorily defined terms. The fact that we sense that some gaps exist in measuring or defining physical dough characteristics should challenge the research-minded to continue the quest for new knowledge in this area.

All through the comment on flour grade runs the feeling that the ash test operates under limitations in defining this factor. It is charged with contributing to false values, economic penalties in the mill and the rejection of good milling and baking wheat simply because the mineral matter content of the wheat is high. Despite the efforts and the failures of the past, further effort is warranted. It is just possible that with advancing knowledge and experience, along with new tools the time may be ripe to uncover a method which with fidelity and acceptable accuracy will define flour grade.

Well, where do we go from here? Perhaps I should commit myself to the extent of advancing a tentative outline for flour specifications around which to focus thinking and as a point from which to work. Here it is:

"Bread flour purchased for use in ..... during the ..... season must conform to the following specifications:

**Ash at 14% moisture basis—**

Not over ..%

(It is the intent of this specification to provide a ..% patent flour.)

**Protein at 14% moisture basis—**

Not less than..%
Not more than ..%

**Gassing Power—**

....mm. to ....mm. Hg.

(Gassing power values are expressed in terms of pressuremeter re-

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**Color**—Clean, bright, white, practically free from creaminess.

(Color is judged by the usual slick test and as crumb color in the test loaf.)

**Maturing**—Maturing and color removal should be attained with the use of chlorine dioxide and benzoyl peroxide.

(The flour should be so matured as to give the color desired without impairment of baking properties. Treatment will vary with individual mills and will be adjusted by means of baking tests in our laboratories on samples submitted by the mills.)

**Farinograph Mixing Time**—

Not less than .... min.
Not more than .... min.

(Farinograph mixing time and absorption are determined by utilizing 500 Farinograph units as standard consistency and using a 300-gram sample, "as is" basis, with the large bowl.)

**Farinograph Absorption**—

Not less than ....%

The flour must be milled from ..... wheat, must be clean and sound and must bake satisfactorily in our laboratory. The method used is the straight dough, basic formula, fixed condition pup loaf procedure formerly referred to as the A.A.C.C. tentative standard baking test.

The flour must conform in every way to the requirements of the U.S. Food, Drug and Cosmetic Act of 1938 and any applicable standards and regulations promulgated thereunder."

This is an attempt to define the challenge that flour specifications bring to cereal chemists. Individually and in association activities it is to be hoped that it will be accepted and that cereal chemists will marshal their abilities and facilities so that they may organize to channel collaborative effort along lines to bring order out of chaos and to assure early results.

Once the ice is broken, once the first step is taken, the fruit of such labor, which is sure to result, will encourage cereal chemists to exercise greater initiative and effort in the solution of other problems awaiting attention.

Once we set our sights thus, we will at last be directing our efforts along lines which will discharge our obligations as professional men. We will be launched on a program destined to enhance the appreciation of our contemporaries for our contributions to science, technology and industry. We will contribute to an environment more favorable to improving the economic status of chemists. What will be the answer in time? Mediocrity or virile accomplishment?

v v

**EDITOR'S NOTE: The foregoing article is the text of an address presented by Mr. Garnatz before several sections of AACC. It appeared originally in the February, 1952, issue of "Transactions," official AACC publication.**

——BREAD IS THE STAFF OF LIFE——

## Herringbone Gears

Helical gears may of course be cut either right or left hand. From this fact, some mechanic was seized with the idea that if two helical gears (one righthand cut and the other lefthand cut, but otherwise the same in all respects) could have their faces joined together in such a manner as to make one gear, and if two such dual gears could then be meshed together, they would run together the same as helical gears, and end thrust generated by one half of such a composite gear would automatically cancel out end thrust generated by the other half. Thus the herringbone gear was evolved and machines were eventually developed which would accurately generate herringbone gear teeth.

Teeth in herringbone gear, as they come into contact with teeth of the mating gear, always have two contact points instead of one, as is the case with the ordinary helical gear. Thus, there is a distribution of the load over a much greater part of the gear teeth, and transmission of much greater horsepower can be safely effected through much smaller gears than might safely be used otherwise.

Herringbone gears were actually produced at first by riveting or bolting two separate helical gears together. Later, they were made from a single blank, but for a while it was necessary to have a center groove around the gear, because it was not found possible to cut such gear teeth so they would actually join properly at a centerwidth of the gear face. Herringbone-gear generating machines now in use, however, make perfect gears without a center groove. Such gears are particularly well adapted for very heavy machinery, for cases where a high peripheral velocity on a gear is a necessity, and where

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high ratios of speed reduction must be obtained as between one pair of gears.

## Internal Gears

While most men know what an internal gear is, and know that an internal spur gear is used in connection with a smaller external spur gear to transmit power from one element to another, they often do not give such gears sufficient thought to realize their advantages.

The machine designer very soon learns that use of an internal gear gives him a much more compact mechanism, because the centers on which the two gears revolve are so much closer together than they can be efficiently made with two external spur gears operating as a pair. Thus, a large amount of speed reduction may be obtained in a small space.

There is also a more efficient rolling action between two spur gears when one of them is an internal gear, and there is more intimate contact of teeth, because the tooth line of both gears curves in the same direction. There is reduced friction and vibration, and there is greater strength with a given material, because more teeth are always in mesh.

Internal gears are often made in the form of open rings, which, after having their teeth cut, may be concentrically attached to the side of a flywheel, sprocket, pulley or other power-transmission device. In many other cases, gear blanks for internal gears are made in the form of a modified shallow cup, so teeth can be cut on the inside of the rim, and the solid back of the gear may be provided with a hub, and thus be attached directly to a shaft. An internal gear is always the outer encircling member of a planetary gear setup, in any case where such a layout is needed in a given mechanism.

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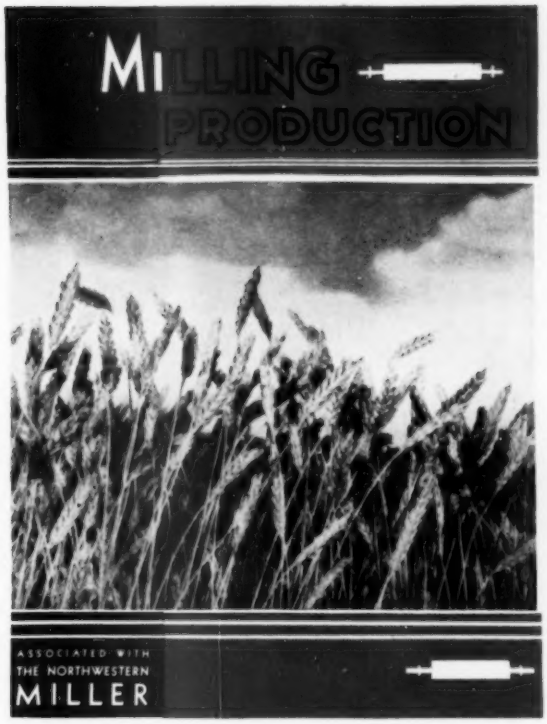


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